

# An Efficient, Reliable, Vibration-Free Refrigerant Pump for Space Applications, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



## ABSTRACT

NASA's future remote sensing science missions require advanced thermal management technologies to provide effective cooling for multiple instruments and reject heat through multiple radiators. Two-phase pumped loops are an ideal solution for these applications. A critical need for these pumped loops is a refrigerant pump that reliably circulates very slightly subcooled liquid refrigerant in the loop. To this end, Creare proposes to develop an efficient, vibration-free pump that has design features to prevent cavitation in the pumping chamber and in the hydrodynamic fluid bearings, and thus enables the pump to achieve a long service life. The development of the refrigerant pump will be built on Creare's proven high-speed turbomachine technologies for space applications. In Phase I, we will prove the feasibility of the refrigerant pump by developing a preliminary pump design, predicting its overall performance, and demonstrating its key features by testing. In Phase II, we will optimize the pump design, fabricate the pump, demonstrate its steady state and transient performance in a representative pumped loop, and deliver it to NASA JPL for further performance evaluation.

## ANTICIPATED BENEFITS

### To NASA funded missions:

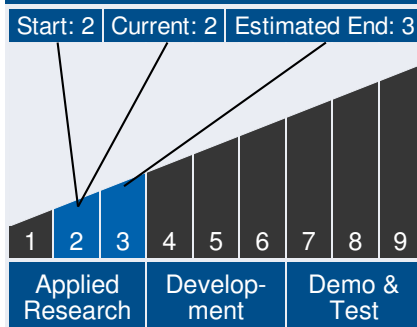
Potential NASA Commercial Applications: The proposed refrigerant pump will enable reliable two-phase pumped loops for efficient and precision thermal control of critical instruments in remote sensing science satellites and exploration vehicles, including the Surface Water and Ocean Topography (SWOT) mission that aims to survey Earth's surface water and map ocean surface height with greater detail than previously recorded. The pump technology also has applications in circulating condensate in water recovery systems, in mixing and transferring cryogenics and propellants in space propellant depots.



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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

### Program Manager:

- Carlos Torrez

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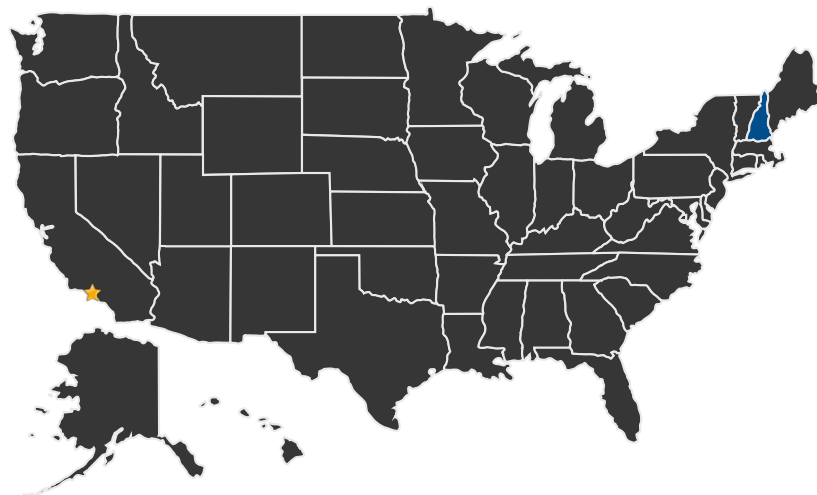
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## To the commercial space industry:

Potential Non-NASA Commercial Applications: The reliable refrigerant circulation pump technology also has applications for advanced two-phase thermal control systems for high power electronics systems in commercial and military satellites and aircraft, as well as circulating pumps for chemicals, fuels, and cryogenic fluids.

## U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ Lead Center:  
Jet Propulsion Laboratory

## Other Organizations Performing Work:

- Creare, LLC (Hanover, NH)

## PROJECT LIBRARY

### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/23564>)

### Management Team (cont.)

#### Principal Investigator:

- Weibo Chen

### Technology Areas

#### Primary Technology Area:

Thermal Management  
Systems (TA 14)

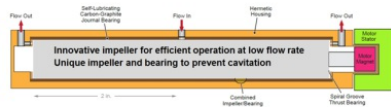
- └ Thermal Control Systems (TA 14.2)
  - └ Heat Transport (TA 14.2.2)

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## IMAGE GALLERY



*An Efficient, Reliable, Vibration-Free  
Refrigerant Pump for Space  
Applications, Phase I*

## DETAILS FOR TECHNOLOGY 1

### Technology Title

An Efficient, Reliable, Vibration-Free Refrigerant Pump for Space Applications, Phase I

### Potential Applications

The proposed refrigerant pump will enable reliable two-phase pumped loops for efficient and precision thermal control of critical instruments in remote sensing science satellites and exploration vehicles, including the Surface Water and Ocean Topography (SWOT) mission that aims to survey Earth's surface water and map ocean surface height with greater detail than previously recorded. The pump technology also has applications in circulating condensate in water recovery systems, in mixing and transferring cryogenics and propellants in space propellant depots.